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Self-examination, compassion and narrative imagination in students' critical examination in science education

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ABSTRACT

The interest of this study is in how science education may contribute to cultivating democratic citizenship in a globalised world. The drive for joint global action and a mutual sense of responsibility for achieving a sustainable future need to be balanced with consideration for inequalities, accountability and differences in agency among people around the world. This raises questions of what citizens need to know, do, and feel to respond to the contemporary and future needs of a broader humanity. We explore how Martha Nussbaum's notion of world citizenship (1997) may be used to expand the understanding of critical examination of socioscientific controversies in science education. We analyse how groups of upper secondary science students engage in a critical examination of dairy and oat milk production and consumption from multiple perspectives. The study exemplifies how the critical examination of science may be recognised not only as source critique, but also as a way to: critically examine norms, traditions and personal habits; recognise oneself as bound to others by mutual concern for human and environmental wellbeing; imagine pathways to a sustainable future; and make moral judgements on a cow's right to life.

1. Introduction

Becoming an educated citizen means learning a lot of facts and mastering techniques of reasoning. But it means something more. It means how to be a human being capable of love and imagination. We may continue to produce narrow citizens who have difficulty understanding people different from themselves, whose imaginations rarely venture beyond their local setting. It is all too easy for the moral imagination to become narrow in this way. /.../ But we have the opportunity to do better, and now we are beginning to seize that opportunity. That is not political correctness; that is the cultivation of humanity (Nussbaum, 1997 p. 14).

Democracy is by no means self-sustaining — it must continuously be upheld through the engagement of citizens whose care and sense of responsibility encompass all humans rather than just their local neighborhood (von Wright, 2002). In any democracy, education, as a pre-requisite for the fostering of citizens who are able to secure and enact democratic values in society, is given primacy. The overarching interest of this study is how science education, when it connects students emotionally to a topic, may contribute to cultivating democratic citizenship in a globalised world. With rapid technological development, globalisation, and the need to achieve a sustainable future as the backdrop, citizens in contemporary societies are challenged to navigate complexity and opposing views on issues of concern. Across education systems, conceptual frameworks such as “21st century skills” (e.g., Dede, 2010), “the Sustainable Development Goals” (United Nations, 2015), and “Global Citizenship Education” (UNESCO, 2018) have contributed to informing

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policy about the importance of students' critical reasoning, self-awareness and encounters with plurality in education.

The notion of democratic citizenship has also been studied in the field of humanistic perspectives on science education. Humanistic perspectives offer an understanding of science as embedded in cultural, economic, social, and political contexts (Aikenhead, 2006). An interest in engaging students in science as it is encountered in society can also be linked to research approaches such as science-technology-society (STS) instruction (e.g., Aikenhead, 1985, 1994), science-technology-society-environment education (STSE) (e.g., Pedretti, 2003), and the socioscientific issues (SSI) approach (e.g., Ratcliffe, 1997; Sadler, 2011). Related research has provided knowledge about the contributions of science education to fostering democratic citizenship with regard to students' decision-making and argumentation skills (e.g., Author & colleague, 2015; Erduran & Jiménez-Aleixandre, 2007), risk assessment (e.g., Christensen, 2009), critical reasoning (e.g., Belova & Eilks, 2016), and students' understanding of how knowledge, values and experience interplay in society (e.g., Author et al., 2016). Pointing to tensions between a sense of the urgency of contemporary sustainability issues and the need for democratic participation, van Poeck and Vandenebeele (2012) suggest that related issues should be viewed as matters of public concern. Framed within Education for Sustainable Development (ESD), such an approach offers an understanding of citizenship that goes beyond the competences or achievements of individuals to focus on a collective engagement in democratic practices where issues of public concern are negotiated and resolved. The urgency of addressing sustainability issues such as climate change is contributing to an increased interest in the role of science education in promoting student activism and deliberation (e.g., Bencze & Alsop, 2014; Caiman, 2015; Lundegård & Caiman, 2019; Vesterinen et al., 2016).

Across studies, dominant methods include introducing students to contemporary issues in the form of ongoing public debates where multiple perspectives and values are heard and conflicted, and to which issues there are no well-defined solutions or accountabilities (Nielsen, 2013). Content-wise, previous research about students' critical engagement with science-related issues in the media span a broad range of topics, inter alia, global warming (e.g., Eggert et al., 2017), GMOs (e.g., Christenson & Chang Rundgren, 2015), vegetarianism (e.g., Jiménez-Aleixandre & Brocos, 2017), vaccination (Lundström et al., 2012), and the risks of radiation (e.g., Wojcik et al., 2019).

1.1. Critical examination in science education

It has been suggested that science teachers play an important role in arranging and supporting activities where students are invited to navigate and critically examine controversial issues such as the aforementioned in all their complexity, bringing differences of opinion and plurality to the fore (Solli et al., 2018). Yet, "if science education is so complex, then how should we sense it, how should we know it, and how should we perform it?" (Alsop, 2017, p. 273). Alsop (2017) argues for educators to venture beyond dualisms such as body and mind, or right and wrong, or delimiting the purposes of critical scrutiny into a mere search for the "truth". He argues that the promise of a critical engagement with science lies in the possibilities for us to become aware of and question the assumptions and practices underpinning the way we think, act and live. Acknowledging the prominence of knowledge about (or how) science "works" in a recent publication, Höttecke and Allchin (2020) stress the role of understanding the epistemic nature of science practices as well as science communication practices in qualifying students' critical encounters with science in the media. The authors hold that students need to develop a "bird's-eye" perspective on how knowledge is produced and mediated, including their own role as consumers. "A science media-literate person, therefore, has developed a deep understanding about the significance of media (including those with and without gatekeeping, or curation) and how they contribute in the public sphere to the construction and shaping of scientific knowledge" (p. 18). Another dimension of critical examination with relevance for how it qualified in science education, is suggested by Latour (2004). Latour argues for a criticism that develops, rather than debunks, things and ideas. By pointing to critical scrutiny as a way to construct and add new ideas to "matters of concern", he questions the notion of critical reasoning as a mere deconstruction of facts, including the practices in which related facts have been produced. This raises questions about what may constitute matters of student concern, and how students can be invited to participate in creatively developing related matters.

As for the potential for science education to nurture students' critical engagement with science for purposes beyond finding and defending the one right answer, the role of conflict and consensus is key. This has been empirically investigated in a recent study by Jiménez-Aleixandre and Brocos (2017). Drawing on an understanding of agreement as a "willingness to take something into account in one's reasoning", the authors examine how Spanish teacher students negotiate how perspectives of nutrition, ecology, economy, ethics and culture become relevant in examining vegetarianism (p. 121). The result shows that Galician economy and food culture (where meat is integral), as well as the image of vegetarianism as "associated with outsiders" in Spanish and Galician society, had significant weight in students' discussions (p. 136). The study also concurs with previous findings on students' willingness to neglect scientific evidence (for instance about nutrition and ecology) that contradicts culturally laden opinions and beliefs. How science becomes relevant in students' reasoning has also been analysed by Arvola Orlander and Lundegård (2012), who investigated how 15-year-old students engaged with the topic of abortion in a science classroom. The results show that the students engaged in the topic in ways that were meaningful for them. In examining abortion, the students gathered arguments from broad point of view, picturing the human body holistically, without dividing it into physical and social aspects. One of the conclusions was that focusing on students' use of scientific concepts alone in socioscientific reasoning risks reducing the importance of other meaningful voices and perspectives.

Acknowledging the challenges in navigating multiple perspectives on complex societal issues that relate to science, Kahn and Zeidler (2016) emphasise the fostering of students' socio-emotional skills to afford flexibility in reasoning. By synthesising knowledge about perspective taking as developed in the fields of humanities, performing arts and the social sciences, the authors advance a theoretical model of how perspective taking can be developed through, for instance, role play and discussions, in the context of science education. It is argued that teachers' use of prompts designed to raise students' awareness of their own biases, beliefs and emotions may be crucial in developing perspective taking.

1.2. Science education for world citizenship

In this study, we adopt the notion of “world citizenship” (Nussbaum, 1997) that offers new perspectives and insights into what abilities are needed for critical engagement with science-related issues in a globalised world. Aligning with the aforementioned humanistic approaches to science education (e.g., Aikenhead, 2006), Nussbaum argues that societal issues (in which science plays a role) constitute a promising starting point in an education for citizenship. She concludes that “issues such as agriculture, human rights, ecology, even business and industry, are generating discussions that bring people together from many nations” (1997, p. 6). Complementary to previous approaches, Nussbaum pays particular attention to the interplay between critical, moral and emotional dimensions of citizenship. She offers a philosophical rationale for “world citizenship” education that focuses on people’s willingness to expand their circles of whom they care about to connect themselves to a greater humanity. She therefore argues for an education that invites students to see themselves as bound to all other humans, to critically examine norms and traditions in society and to compassionately take the perspectives of others.

To realise the goal of cultivating humanity in the context of science education, students’ examination of contemporary lifestyle-related issues must not only be enacted as verbal and intellectual argumentation, but as confrontations with their own and others’ emotions, habits, and ways of living (von Wright, 2002). Such an education enables the students to become aware of and critically examine their own and societal views, and to consider the desires and needs of other humans and nonhumans, using imagination. Considering the way science permeates our lives, for instance through medicine, nutrition, information technology and agriculture, science education provides rich opportunities for inviting students to engage in such work. People’s understanding and scrutiny of factual scientific knowledge undoubtedly play a key role in examining science the way it is encountered through media in everyday life (Author et al., 2016). Yet, the magnitude and complexity of contemporary sustainability issues challenge people’s abilities to make lifestyle-related moral judgements in ways that are informed both by established knowledge and the values, needs and conditions that underpin different ways of living. Also, the urgency for joint global action and a mutual sense of responsibility for achieving a sustainable future need to be balanced with global inequality, accountability, and the differences in people’s agency. This raises questions about what citizens need to know, do, and be able to feel in order to respond to both the contemporary and future needs of a broader humanity.

The aim of this study is to explore how students’ critical examination in science education may be understood from the perspective of world citizenship.

2. A theoretical perspective on critical examination

2.1. World citizenship education — a project of cultivating humanity

From Nussbaum’s viewpoint, educating citizens of the world is a project of cultivating humanity, “[t]hat is a cultivation of the whole human being for the functions of citizenship and life generally” (1997, p. 9). Her framework revolves around the question “[w]hat does the ‘cultivation’ of humanity require?” (p. 9), and her answer directs our attention to ancient Greek philosophy. Drawing on the Socratic idea of “the examined life”, and the notions of dignity and human flourishing associated with Aristotle, she argues for a particular norm of citizenship and makes educational proposals following that ideal. Nussbaum distinguishes three closely interrelated capacities essential for cultivating humanity: 1) the ability to critically examine oneself and one’s traditions; 2) the ability to see oneself not only as a member of a local group but as bound to all other humans; and 3) the ability to put oneself in another person’s shoes to understand their emotions and desires — that is, to practise narrative imagination.

In discussing the notion of “world citizenship”, Nussbaum refers to both “ability” and “capacity”. “Ability” is used to describe qualitative aspects of each “capacity”, illustrating what sort of doing or being in the world a certain capacity may enable. Nussbaum uses the notion of “capabilities” to represent “[a]reas of freedom so central that their removal makes a life not worthy of human dignity” (p. 31). In this study, our focus is on the notion of “world citizenship” and how it may bring to the fore dimensions of critical examination less addressed in science education research and practice.

2.1.1. Critical examination of oneself and one’s traditions

The first ability outlined by Nussbaum aligns with the ideal of Socratic self-examination. From Socrates’ viewpoint, critical examination of oneself is conditioned by our ability to identify and question authoritative voices in society, for instance, in the form of traditions, norms, habits and institutions. Or, as Nussbaum puts it, by people’s ability to “give reason for what they choose, and think reflectively about moral controversies” (p. 45). Yet, the notion of “self” is not restricted to an examination of the individual by the individual. Nussbaum points out that since views and habits are shaped in social contexts, it is possible to renegotiate and reframe them collectively. Opportunities to become aware of ourselves and the society in which we live, and to expand our repertoire of possible ways of living, emerge as we are confronted with difference. By contrasting what is unfamiliar with what is already known we learn about ourselves and our society through others, and about others through ourselves. Nussbaum argues that critical self-examination implies reasoning guided by logic, consistency, and facts. However, exercising logical analysis and argumentation does not necessarily provide students with opportunities, or incentives to actually change or renegotiate their present views or habits, or at least look into their foundations. A not so far-fetched assumption is that, to manage the educational demands on their critical reasoning and rational argumentation, students may be tempted to detach their lived experiences and emotions from the values and positions they articulate in class. Nussbaum therefore advocates an education that is “very personal /.../ suited to the pupil’s circumstances and context”, and pluralistic in that it is “concerned with a variety of different norms and traditions” (p. 32). Thus, in science education, critical

examination should be made more relevant to the lives and societies of the students. Such opportunities emerge as the students are invited to examine contemporary controversies that have personal relevance for them and that bring multiple perspectives, including ethical values, to the fore.

2.1.2. *To see oneself as bound to other humans*

The second ability that Nussbaum describes as essential for cultivating humanity encompasses seeing ourselves as “not simply a citizen of some local region or group but also, and above all, as human beings bound to all other human beings by ties of recognition and concern” (p. 10). Nussbaum proposes a meaning for world citizenship that encompasses acting and managing one’s life in ways sensitive to the situations and desires of fellow citizens. She points out that empathy and compassion, rather than facts or knowledge, are what genuinely bring different people together. Her emphasis on “common needs and aims” is tied to our ability to accept differences in how such aims and needs may be articulated and enacted, rather than striving for consensus on one “right” way to live. Nussbaum argues that compassion and empathy may be developed in an education that focuses on pluralism in the sense that it allows students to discern alternative ways of being and doing in the world. One possibility is to raise students’ awareness of cultural difference, which “is essential in order to promote the respect for another that is the essential underpinning for dialogue” (p. 68). Any living condition is in itself diverse and encompasses resistance, criticism and controversy.

Later, Nussbaum (2000, 2004, 2011) extended the capabilities approach to include animals. She argues that animals are also subjects of justice and not just objects for human compassion. She writes that “[a] duty of compassion would not be just a duty to have compassion, but a duty, as a result of one’s compassion, to refrain from acts that cause the suffering that occasions the compassion” (p. 302). Thus, by acknowledging animals as agents, Nussbaum points to the moral agency in humans to secure animal entitlements to basic justice. Building on the list of ten Central Capabilities, Nussbaum (2011) holds that animals are entitled to, for instance, life, bodily health, bodily integrity, and control over one’s environment (Nussbaum, 2004, pp. 315–317). Judgements on whether animals are given their rightful opportunities to flourish need to account for these entitlements in relation to the capabilities of each species.

2.1.3. *Narrative imagination*

The third ability of democratic citizenship can be described as a synthesis of critical self-examination and seeing oneself as bound to other humans, as described above. Nussbaum refers to this ability as “narrative imagination”. She describes it as a “particular form of vision” that opens up spaces to transcend one’s individual position or perspective to shape an informed and compassionate understanding of another person or group of people (p. 88). Practicing narrative imagination means envisioning what it might be like in the shoes of a person different from oneself. It involves alternating between compassionate understanding of others and becoming conscious of oneself. Nussbaum writes that “[c]ompassion, so understood, promotes an accurate awareness of our common vulnerability” (p. 91). As outlined in the introduction, lifestyle-related issues that touch upon sustainability cannot be resolved without taking multiple perspectives and ethical considerations into account. In the process of scrutinising our own beliefs and taking the perspectives of others are possibilities for making moral judgements, and for letting such judgements guide responsible citizenship. Narrative imagination thus becomes pivotal to moral interaction and awareness of how human needs shaped by different circumstances may vary.

In this study, we focus specifically on the roles of self-examination, compassion, and imagination in students’ encounters with a complex societal issue that relates to science.

The research question addressed is:

- How may the examination of dairy and oat milk from perspectives of sustainability enable students’ enactments of “world citizenship” (in the sense of critical examination of oneself and one’s traditions, and seeing oneself as bound to other humans and animals, and to narrative imagination)?

3. Study setting

This study is built on some Swedish upper secondary school students’ group examinations of dairy and oat¹ milk production and consumption, in which moral judgements about sustainability and people’s quality of life come into play. The group discussions were organised as part of a research project aimed at developing teaching, learning and assessment practices concerning students’ critical examination of issues related to science, lifestyle and sustainability. The research project was a one-year research collaboration between two researchers (author 1 and author 2) and five science teachers. The teachers were recruited from five Swedish upper secondary schools varying with respect to programme specialisations, and geographic and socioeconomic spread. 130 upper secondary school students (aged 16–17) attending a vocational or study preparation programme at these schools gave their informed consent to participate in a classroom intervention.

¹ Since December 2013 EU regulations have stated that words relating to dairy products, such as “milk”, “butter” or “cheese”, cannot be used for marketing or advertising plant-based food alternatives. Accordingly, oat-based beverages are sold as “oat drinks” in Sweden. However, we use the word “oat milk”, since this is how oat-based beverages are referred to in the transcripts, and in Swedish society in general.

3.1. The case of teaching critical examination through the Swedish milk controversy

At the time of the intervention, a controversy between an oat milk company and a dairy company in Sweden was creating significant media attention which led to a societal debate about sustainable lifestyle choices. In all its complexity, the debate features the typical characteristics of a socioscientific controversy (Solli, 2019; Solli et al., 2017; cf. *socioscientific issues*, Zeidler & Keefer, 2003; Zeidler et al., 2005). Socioscientific controversies are defined as complex societal issues cutting across various disciplines of knowledge (of which science is but one) and involving several actors with different interests and affiliations. In Sweden, multiple perspectives and conflicting voices about milk (including the dairy industry, oat milk producers, farmers, nutrition researchers, animal rights activists and lay people) are heard and disseminated in the news and on social media.

Dairy milk holds a special cultural-historical position in Scandinavia, established and upheld through cooking traditions, education, media, and not least the dairy industry itself. In Sweden, dairy products are associated with values that relate to health, youth, naturalness, and nostalgia (Jönsson, 2005). The dairy milk–health connection can be traced back to Swedish Milk Propaganda [in Swedish *Mjölpropagandan*], an association formed in 1923 and financed by the Swedish government and milk producers which successfully branded dairy milk as a bone strengthening and “reliable” beverage especially suited for nourishing children and sick people (Mjölpropagandan, 1933). Even though Swedish dairy milk imports have increased by 35% over the last ten years, dairy production is still the highest-grossing agricultural sector in Sweden (The Swedish Agriculture Department, 2018). The cultural preference for dairy and high levels of trust in the dairy industry is visible in Swedish schools. Dairy milk is commonly served with lunch in Swedish schools, and, unlike other commercial actors, dairy companies are allowed to display advertisements in schools (Jönsson, 2005).

Despite the traditionally strong position of dairy in Sweden, the image of milk as a healthy, natural, and sustainable choice of beverage is increasingly being challenged. A recent report from The Swedish Agriculture Department (2018) indicates that the production and the consumption of dairy milk in Sweden is declining. Criticism of the dairy industry in Sweden has recently been illuminated in an ethnographic field study of pasture release² and open farm events in Sweden (Linné & Pedersen, 2016). Drawing on critical animal theory, the authors examine how Swedish dairy industries “embody, shape and legitimize certain values and ideals of human-bovine relations” (Linné & Pedersen, 2016, p. 111). The critique concerns the moral dimensions of how the dairy industry transitions milk cows from “animal to commodity” through the use of promotion strategies tailored to reach a younger generation through education and family life (Linné & Pedersen, 2016, p.117; see also Dinker & Pedersen, 2016).

Based on the ongoing societal debate about dairy milk, and oat milk as a locally produced substitute, the classroom intervention was conducted over two 80-min lessons by each of the five teachers as part of their Science Study (*Naturkunskap*) class. During the first lesson, the students individually searched for online information about the two milk drinks. The student group discussions were held during the second lesson of the intervention, during which the students were engaged in a task to jointly examine the two milk drinks. Before the discussions started, the teachers informed the students both orally and in writing that the task was to identify and critically examine relevant perspectives on the issue, rather than to bring forward and defend personal standpoints in a polarised debate. However, to end the group discussion, as an optional closure, the students could choose to voluntarily present their own standpoints (if they had such and wanted to).

3.2. Data collection

The empirical data consist of video recordings from 10 student group discussions (3–6 students in each group). To ensure the integrity and voices of the students, the video-recorded groups were informally selected in that one, or a couple of groups in each class volunteered to have their conversations recorded. The voluntary aspects may have favoured the voices of more outspoken and self-confident students in the material. To afford variation in how the students engaged with the task, the participating schools were selected to represent a spread with regard to school programme (vocationally oriented and academically oriented: science and non-science specialisation), school type (public school and charter school) and socioeconomic spread. In addition to the teacher, the first author was present for data collection in all classes during the second lesson. Each recorded group discussion (of approximately 30 min) was transcribed by the first author.

The recordings have been transcribed verbatim with instances of hesitations (e.g., “hm”), pauses (...) and giggling [laughter] marked. We are aware that converting the students’ conversations from spoken to written language reduces the reproduction in the transcripts of non-verbal nuances and dynamics such as body language and gestures. Nodding, however, has been captured.

3.3. Qualitative content analysis

To discern qualities in students’ participation in critical examination, we used the framework of qualitative content analysis (QCA; Graneheim & Lundman, 2004; Graneheim et al., 2017). We performed a QCA in four steps, including: 1) discerning meaning units; 2) condensing codes; 3) creating categories; 4) formulating themes across students’ discussions.

Table 1 illustrates how we applied the QCA framework and how the four steps of analysis relate. During the first three steps of analysis, we searched for areas of content in the student conversations without predefined categories. In the first step of the analysis,

² Pasture release [in Swedish *betesläpp* or *kosläpp*] occurs during spring and is the moment when the cows are released for pasture and grazing after having been held in barns during the months between the growing seasons.

meaning units were discerned. Column 1 in Table 1 exemplifies meaning units that were extracted from the transcripts. The meaning units were discerned from all episodes and constitute instances of student talk about topics related to the production and consumption of dairy and oat milk. In the second step, each meaning unit was condensed into a code in a process of shortening the original meaning unit while still preserving the core meaning (Graneheim & Lundman, 2004). Table 1 illustrates how the four meaning units in Column 1 were condensed into four codes in Column 2 labelled as: “It’s made for calves”; “We use very rough methods to get the milk”; “They are mostly confined”; and “People are aware because milk has been promoted”. The third step of analysis involved grouping the codes into categories. The categories deal with the “what” dimension of the conversations and how different content related to a topic was covered in the conversations (Graneheim & Lundman, 2004). Here, the categories represent the focal topics in the students’ critical examination of dairy and oat milk across the different groups. Column 3 in Table 1 illustrates how the four codes in Column 2 were sorted into three categories. The categorisation was conducted and developed continually until all meaning units had been categorised, and the categories were internally homogeneous and externally heterogeneous.

The themes were formulated to answer the question: “What critical examination is enacted in student conversation?” Formulating themes allows us to make theory-infused interpretations of what is articulated in the data (Braun & Clarke, 2006). The themes were developed using the notion of “world citizenship” education (Nussbaum, 1997). Epistemologically, students’ critical examination of cow’s and oat milk is viewed as socially constructed (located in the social relations between the students rather than as inherent to individual students) and embedded in specific educational practices of upper secondary science studies (Lave & Wenger, 1991). Following this, the themes are articulations of students’ collective participation in practices of critical examination across the student groups. Thus, the themes illustrate the repertoires available to the students for engaging critically with the milk issue. More specifically, each theme was formulated and expanded with respect to how the students engaged in critical examination as ways to scrutinise themselves and society, seeing themselves as bound to other humans, of imagining narratively and understanding science. The themes are interrelated and provide examples of how the capacities tied to world citizenship overlap and relate. Altogether, the themes illustrate how “world citizenship” is enacted in students’ examination of dairy and oat milk.

Columns 3 and 4 in Table 1 illustrate those episodes during which the students discussed what is “natural” or “unnatural” for humans to drink; animal rights to autonomy and to live without suffering were interpreted as instances of students’ examination of the issue from an ethical perspective, here formulated as the theme “Challenging values about the production and consumption of dairy and oat milk”. Episodes that focused on the role of media, industry, and education in establishing norms around beverage choices were interpreted as “Issues of awareness about beverage choice”.

4. Results

The results of the qualitative content analysis are presented as three themes: A. *Challenging values about the production and consumption of dairy and oat milk*; B. *Examining the impacts of milk production and consumption on human health and the environment*; C. *Issues of awareness about beverage choice*. Altogether, the themes illustrate the perspectives addressed in students’ examination of the sustainability of dairy and oat milk, respectively, and how “world citizenship” (Nussbaum, 1997) is enacted through students’ engagement with the issue.

Across the groups, the students centre their examination of the milk issue around several perspectives, covering dimensions of

Table 1

An illustration of how the four steps of the qualitative analysis framework were applied (Graneheim & Lundman, 2004).

1. Meaning units	2. Codes	3. Categories	4. Themes
Lea: But the problem is that [dairy] milk is, like, not really made for humans, hm. It’s made for calves.	It’s made for calves.	The notion of what is “natural” or “unnatural” for human beings to drink.	<i>Challenging values about the production and consumption of dairy and oat milk</i>
Sam: But how do we torture ... we use very rough methods to get the milk and then, well maybe not in Sweden but... then we have... Yeah, well it’s not that good either actually. But we have pretty rough ways to produce that milk.	We use very rough methods to get the milk.	Animal rights to autonomy and to live without suffering.	
Elsa: The cows can’t walk around freely. They can’t forage freely. It’s very controlled and they are mostly confined.	They are mostly confined.		
Malin: But why aren’t more people drinking oat milk then, if there are so many positive things...? Tove: But it’s... Ruben: But not so many people are aware of it just because [dairy] milk has been promoted as something very very good. Li: It’s like with Arla’s commercial. I think it’s, like, “The drink of nature” right? Ruben: “Nature’s own sports drink”. Li: Yes exactly. “Nature’s own sports drink”. You get the sense that... shit this is, like, really good. That’s what happens.	People are aware of it just because [dairy] milk has been promoted.	The role of industry and media.	<i>Issues of awareness about beverage choice</i>

environment, health, ethics, food culture and economy. They also illuminate the milk issue from individual or personal as well as from societal or global standpoints. This is, for instance, illustrated in students' ways of examining norms around beverage choices as established through family life and home cooking traditions, as well as through education, industry and the media. In their joint examination of dairy and oat milk, the students reflect upon the trustworthiness of the information that they encounter on the Internet. For instance, they examine the purposes, qualifications, transparency, and potential biases of various sources on dairy and oat milk. Furthermore, the results also illuminate qualities in the students' examination of the two milk drinks that go beyond discerning relevant perspectives and scrutinising sources on the Internet. Altogether, the themes illustrate how the students examine dairy and oat milk in ways which align with Nussbaum's notion of "world citizenship" (in the sense of critical examination of oneself and one's traditions, seeing oneself as bound to other humans and animals, and the practice of narrative imagination). In scrutinising sources on the Internet, the students engage in epistemological reflections about how knowledge about nutrition is produced in related research practices, and further, reason critically about the role of facts, experiences, values and opinions in the production and consumption of the two milk drinks.

4.1. Theme A: challenging values about the production and consumption of dairy and oat milk

The first theme illustrates how the students examine the consumption and production of milk as a cultural phenomenon and the norms that govern consumption of such beverages. This theme provides examples of how the students identify, question and negotiate societal norms, personal habits and family traditions around the consumption of dairy products. Contrasting how people from different parts of the world consume milk, and looking at how mother's milk is consumed by other species, opens up spaces for the students to scrutinise their own attitudes to dairy. The students describe what they refer to as "the Swedish milk culture". Identifying Swedish milk culture precipitates an examination of how their own views on milk have been shaped. While engaged in such work, the students identify and question various authoritative voices in Swedish society, including education, market forces and science.

Excerpt A illustrates how a group of students question the authority of norms in society as they elaborate on ways to explain and justify the high consumption of dairy products in Sweden. By positioning themselves as norm-critical, the students confront their own habits around milk and restating the moral values that uphold the special position of dairy in Sweden.

Excerpt A: It's normal but it's not good

1. **Stina:** We have to get to the bottom of this! How reasonable is it that we grown-ups take, hm, drink animal milk from...?
2. **Ebba:** It's, like, really weird, actually. It's, like, a cow child... or a grown-up cow would drink, like, a nursing mother's milk.
3. **Robel:** But there are actually other animal species that drink the milk of other animals.
4. **Ebba:** It's very unclear... Well, I wouldn't actually call us "animal species". [laughter]
5. **Sai:** But we have done it [consuming milk] for a very very long time.
6. **Stina:** But that's because we haven't had anything else.
7. **Sai:** But I feel that...
8. **Stina:** There haven't been any alternatives.
9. **Sai:** Yeah, I feel that it [milk consumption] is just as normal as eating animal meat.
10. **Robel:** Yeah, it's just as normal... But it's not normal. It's normal but it's not good!
11. **Ebba:** I don't think so, because eating animal meat, hm, that's, kind of, part of the...
12. **Stina:** Food, hm, what is it called, this round circle?
13. **Ebba:** The evolution, exactly! It's the food chain or something. Lions eat animals, but it's not like lions wander around and drink giraffe milk. [laughter]

Stina calls for the group to urgently "get to the bottom" of how the human consumption of dairy milk can be justified (line 1). She questions the rationale behind adults drinking milk from another species. Ebba agrees with Stina and exclaims that the societal norm of drinking dairy milk is "really weird" (line 2). To clarify her point, she invites her peers to take the cow's perspective and to consider a scenario in which cows drink milk from human adults (line 2). When Robel claims that humans are not the only species that drink milk (line 3), Ebba suggests that human and animal milk consumption cannot be compared since humans cannot be called an "animal species" (line 4).

Contrary to Stina and Ebba, Sai expresses positive feelings about drinking milk (line 9) and points out that humans have consumed milk "for a very very long time" (line 5). Stina adds that the tradition of drinking milk may be because there were no alternatives (lines 6, 8). Sai then holds that milk consumption is as "normal" as eating animal meat (line 9). Robel objects to the normalisation of milk drinking, saying that "(i)t's normal but it's not good!" (line 10). In relation to Robel's statement, Ebba reconsiders her earlier statement that humans and animals cannot be compared (line 4). Drawing on knowledge about evolutionary processes she now states that some animals depend on other species' meat (but presumably not on their milk) for survival (lines 11, 13).

Another group of students, in a similar way to the students in Excerpt A, search for ways to explain the special position of dairy in Sweden. However, rather than making moral judgements on the "normality" of the human consumption of cow's milk, the students in Excerpt B are concerned with understanding the sources of their habits and norms around milk.

Excerpt B: Milk has always been promoted

14. **Asima:** Yeah! I believe that, hm, that the Nordic countries are the world's most... I mean, in no other countries do [people] drink milk for dinner!

15. **Axel:** But the countries that drink most milk are actually New Zealand and Australia. I think it was *Arla* [a Swedish milk producer] who had a diagram...
16. **Axel:** But many people in Sweden drink milk because it has been a lot... I mean milk has always been promoted, like, there has always been milk in all schools. Milk and water.
17. **Asima:** Mm. Never oat milk.
18. **Axel:** Never oat milk.
19. **Elvira:** Those who want to have oat milk, they have to, kind of, ask for it especially because it's so "naturalised" that we drink milk.
20. **Axel:** But it could affect... from an economic perspective.
21. **Elvira:** Yeah! It's like one litre of organic oat milk was, like, seventeen ninety five [Swedish crowns, SEK] and organic milk is nine eighty [SEK]. So, there is a price difference.
22. **Axel:** Mm. Yeah!
23. **Elvira:** But you still have to think, like, it may have different reasons. It may be because there's, like, a bigger production of [dairy] milk so maybe they can afford to sell it cheaper.
24. **Johan:** But that was kind of what *Oatly* [a Swedish oat milk producer] wrote!
25. **Asima:** Yeah, exactly. I mean why don't more [people] drink oat milk then? If there are so many positive things...?
26. **Elvira:** But there aren't so many people who are aware of it since [dairy] milk has been promoted as something very very good!
27. **Asima:** And if there was oat milk... for example, in the school. If there was one oat milk machine and one [dairy] milk machine, then at least maybe more [people] would try it.
28. **Elvira:** Yeah! Like normalising it.

Asima frames milk consumption as culturally laden and tied to family traditions, by stating that drinking milk for dinner is a typical Nordic phenomenon (line 14). Axel challenges the notion of the Nordic countries being particularly big milk consumers by referring to data showing that dairy milk is also a popular beverage in other countries (line 15). Nevertheless, he also acknowledges the special position of dairy milk in Sweden and reflects upon how the Swedish norms around dairy milk have been established. Axel suggests that the consumption of milk is due to its promotion in schools, "there has always been milk in all schools" (line 16). In Sweden, students' school lunch is municipally financed, and as suggested by Axel, dairy milk and water are the two beverages commonly offered. The "milk and water" norm in schools is further recognised by Asima who concludes that oat milk is not an option for students (17). Elvira suggests that where oat milk is offered, it is less openly available for students who need to ask for it specifically (19). The students provide examples of how the Swedish milk norm may have been established and upheld in schools, and that students who do not act in line with that norm may be treated differently.

As the conversation unfolds, the students also examine the role of economy and market forces in shaping "Swedish milk culture". Axel and Elvira acknowledge that oat milk is more expensive for consumers than dairy (lines 20–22). Elvira voices the idea that norms may be established by multiple interrelating authorities or forces in society, for instance, education (line 19) and industry (line 23). Johan joins the conversation and questions the trustworthiness of what Elvira just said by pointing out that the information derives from an oat milk producer (with obvious bias; line 24). Referring to the suggested health benefits of oat milk consumption, Asima wonders why few people consume it (line 25). According to Elvira, this is because of people being unaware of it, and further that "milk has been promoted as something very very good" (line 26). Together with Asima, she concludes that bringing oat milk into school canteens, and making it as equally available as dairy milk, would contribute to "normalising it" (lines 27, 28).

This theme illustrates how the students identify the need to reflect upon what is taken for normal and neutral, and, further, how our life experiences shape the way we live. They pinpoint multiple authorities in Swedish society, including norms, education and industry, and further question how such authorities have shaped their own views and habits around milk. For instance, the students in Excerpt B discuss how the consumption of dairy milk has become the norm in Sweden due to its promotion by the dairy industry, as well as due to its accessibility in school cafeterias. The students engage in a critical examination of science in ways that are beyond mere evaluations of scientific evidence or the trustworthiness of specific sources. Central here, is the students' recognition and scrutiny of what is taken for granted in Swedish society (and, by extension, by themselves), as well as their awareness that conceptions of "truth" or "normal" are constructed in social and cultural contexts. This theme also provides examples of how historicity and moral judgements on human behaviour come into play in students' critical examination of science. As the students in Excerpt A reflect upon potential parallels between meat and milk consumption, they express an understanding of societal norms and the notion of "good" as historically contingent. In examining the species norm, the students elaborate on ways to justify dairy consumption as a particularly "human" phenomenon, tied to the conditions for human survival and moral agency.

In considering the dairy industry from an animal rights perspective, the students use their imaginations in trying to understand the position of the milk cows. The students express an understanding of the milk cows as subjects, entitled to a certain level of dignity and the right to flourish. The theme illustrates how the students attribute certain rights to the milk cows, and further how they reflect upon the ways in which, and for what possible reasons, those rights are threatened or abused by humans due to the milk industry. With making cows subjects comes an emerging awareness of how the production and consumption of milk potentially give rise to conflicts between animal and human rights. Identifying such value conflicts opens up spaces for the students to examine and restate both their own value bases and their moral agency as consumers.

In Excerpt C, Bo, Adam, Hannah and Moa examine the production of dairy milk from ethical standpoints. During their conversation, they identify, negotiate and draw boundaries between the different values at stake in ways that are normatively reconcilable with their existing habits and views about milk.

Excerpt C: I'm against milk

29. **Bo:** I'm also against milk... partly because of those environmental reasons and the health reasons and such but, hm, mainly because of the morals, in that we take the milk from another animal and that doesn't feel... I don't think it feels good. That's why I decided to stop drinking milk... because of that reason.
30. **Adam:** Yeah. I'm against milk too but not for the same reasons as him... [nodding at Bo] in that it's immoral to take the milk from another animal. I don't think it's immoral since we slaughter the animals as well. In that case we should stop the slaughtering of animals. Hm, after all I think it is immoral that we can kind of lock lots of cows in one place and rape them to get their milk and then I drink the milk unwittingly... [laughter]
31. **Hannah:** I agree about that last thing [Adam said]. But I stand somewhere in-between because, I mean, our family actually only buys organic milk, and most often then... I mean they treat the cows better compared to non-organic milk. They [the milk cows] get some more space and stuff. And yeah, yeah, I still think that it's strange that we humans at all... like you say... [nodding at Adam] rape cows and then drink the milk, hm, yeah, that's morally wrong I think... but also not, hm, because we do so many things that are even worse... like to slaughter and then eat the meat. Yeah, I guess I stand somewhere in-between, I would say. [all students nod]
32. **Moa:** Mm. After this task I've changed my opinion and I'm also against milk at the moment, hm, because I think that the disadvantages outweigh the benefits because it's, like... considering the moral and, like, you said [nodding at Adam] that we rape the cows to extract their milk and such. It is in that way immoral!

Acknowledging the environmental impact of the dairy industry, Bo expresses a concern about the moral considerations that milk production raises (line 29). He draws attention to “the moral in that we take the milk from another animal” and points out that it “doesn't feel... I don't think it feels good.” According to Bo, the decision not to drink milk is based on a notion of what is right and what is wrong. His peer, Adam, also describes milk consumption as immoral, but “not for the same reasons” that Bo gives (line 30). Adam points out that the same kind of action or standpoint may be justified from different value positions. He suggests that taking the milk from cows can actually be morally defensible provided the cow is used effectively as a resource (for milk *and* for meat). Adam's concern though, has to do with how the milk cows are treated during their lifetime. According to Adam, the milk industry violates animal rights in that keeping cows in barns or behind fences does not allow the cows to move freely. Adam uses the word “rape” to describe the circumstances in which milk cows are inseminated, thereby making the point that the milk industry threatens cows' bodily integrity. At the end of the statement, he also considers the human obligation to know how milk cows are treated — to not drink milk “unwittingly”. Thus, Adam expresses a trust in humans to fulfil their duty of compassion in becoming aware of injustices in the world (line 30).

A third member of the group, Hannah, expresses ambiguity about how to navigate and reconcile conflicting values and provides insight into her family's ways of taking moral responsibility (line 31). She suggests that buying organic milk is a way to consume milk without violating cows' rights to move around freely, at least not to the same extent as would conventionally produced milk. However, she also points out that producing milk organically is not sufficient to secure the animals' entitlement to bodily integrity since the cows are still “raped”. Hannah opposes Adam's utilitarian approach to animal rights by exclaiming that slaughtering animals for meat is “even worse” (than threatening bodily integrity). Hannah is not willing to compromise the animal entitlement to life in favour of humans' access to meat, yet her family's choice of organic milk illustrates her openness to negotiate cows' rights to move around freely. After having listened to her peers' discussions Moa states that she is now “against milk... because I think that the disadvantages outweigh the benefits” (line 32).

Excerpt C illustrates that unfolding the complexity around the milk issue creates opportunities for the students to examine and construct a mutual value base. The students approach the milk issue from multiple ethical standpoints and identify and negotiate potential conflicts between animal and human rights. On a similar note, three students from another group, Frida, Jens and Drew, reflect upon what constitutes animal rights, and whether some rights can be compromised in favour of human needs (Excerpt D). During their conversation, the students examine how certain moral principles may (or may not) be compatible with the dairy milk and meat industry, and thereby guide humans in taking moral responsibility. The excerpt is an example of how the students examine the notion of moral action as conditioned by people's freedom to choose different ways of being and doing.

Excerpt D: They might live a life imprisoned

33. **Drew:** Hm, what do you think about the double standard... that people think that it's immoral to take the milk from the calves but then they happily eat the calves for lunch?
34. **Frida:** That doesn't bother me!
35. **Jens:** I mean we humans have always been hunting.
36. **Drew:** Yeah but we have been *hunting*. We haven't bought [it] like in stores. Packaged.
37. **Jens:** No... they have made it easier now... [laughter]. But it's the same principle.
38. **Drew:** But then it's the same principle with the milk too. So that's OK if they, like, hunters, like, really use [everything]? ... it's like when you eat meat, hm, if you eat meat and there are bones and you even suck out the bone marrow. It's like you really use everything to the very end.
39. **Jens:** That's kind of barbarous!
40. **Frida:** There is a difference, hm, to be shot directly and to spend a life...
41. **Drew:** No! They spend a life, hm, that's where they grow up and then they die.
42. **Jens:** Yeah exactly!

43. **Drew:** It's not like they get shot directly. They spend a life in bad living [conditions].
44. **Frida:** Organic meat is definitely better. I think it's a big difference to be shot or maybe... yeah. They might live a life imprisoned, but they have at least some kind of freedom to graze.
45. **Drew:** It's not like they get shot and then they bleed until they die, hm, and then someone comes along and shoots them right at the end, when they are about to die.
46. **Frida:** Yeah. It's no good to let them live under that tyranny and torture, right?
47. **Drew:** Now you practically say that one [alternative] is bad and the other is worse, hm, that we should stop with what is worse, but we can keep what is bad.

Drew draws his peers' attention to the fact that when it comes to food choices, people tend to apply conflicting moral standards when inconsistently discriminating between various kinds of animal foods (line 33). For Frida, acting from an inconsistent value base is not necessarily a problem (line 34), and Jens points out that humans share a history of dependence on animals for survival (line 35). By contrasting hunting (in nature) with packaged food (from stores), Drew suggests that in contemporary societies humans have radically altered the conditions and circumstances in which animals are exploited (line 36). Jens agrees that humans have made it easier to use animals as a resource (line 37). Drew elaborates on the point that historical hunting is not comparable to milk consumption, rhetorically taking a utilitarian approach to the dairy milk industry (line 38). He concludes that from such a perspective, the dairy milk industry could only be justified if humans used all body parts of the milk cows, just as hunters would do. Drew's statement sparks Jens into exclaiming that using animal resources the same way that hunters do is "barbarous" by today's standards (39). Together, they negotiate whether killing animals for food in the absence of other options can be morally equivalent to eating meat when other food alternatives are available. The students also examine how the non-wasteful use of cows and their products may justify the dairy (or meat) industry.

As the conversation proceeds, Frida argues that hunting and dairy milk production cannot be compared since "there is a difference, to be shot directly and to spend a life /.../ imprisoned" (lines 40, 44). By suggesting that organic dairy milk is better (than conventionally produced dairy milk) since the cows are entitled to "some kind of freedom to graze", Frida explicitly positions the milk cows as subjects of justice, and as such entitled to be free-range (line 44). Thus, Frida examines morality and animal rights from beyond questions of pleasure and pain to encompass cows' rights to flourish. Like Hannah in excerpt C (line 31), she cherishes the milk cow's right to move around freely, and acknowledges that for a cow a life worth living is a life of free grazing, even if the cow is imprisoned and killed in the end. Drew, however, expresses more concern about how the cows are treated during their lifetime, than about the fashion in which the cows are killed. When Frida admits that milk cows actually might be treated badly, Drew ends the discussion in the same manner as he initiated it. His concern is that people's focus on what they find morally "worse" (such as taking milk away from calves or killing cows) may lead them to turn a blind eye to what is morally "bad" (eating calves for lunch or torturing cows).

In the above Excerpt C and D, the students vividly and with strong emotional engagement, examine the conditions of cows in the dairy industry. Taking the milk cow's perspective opens up spaces for the students to view cows as subjects, and to exemplify how the dairy industry reduces the milk cow's rights to reproductive autonomy and free range. Nussbaum (2004) provides examples of circumstances in which the meaning of animal entitlement may be negotiated. For instance, she states that the killing of animals may be acceptable if the animals have had the right to flourish and as long the killing is humane. On a similar note, the students in the above excerpts identify and negotiate tensions between human and animal rights.

4.2. Theme B: examining the impacts of milk production and consumption on human health and the environment

The second theme illustrates how the students examine how the production and consumption of milk may affect people's health and their environment. During the discussions about the environmental impact of the dairy industry, the students identify and problematise a range of relevant issues, including land and energy use, soil composition, ecosystem dynamics, deforestation and human-induced global warming. The students display awareness of the nutrient and energy composition of the two milk drinks, and how these may be either harmful or beneficial for humans. For instance, they point out that both dairy and oat milk may cause allergic reactions due to allergens such as gluten and lactose, that the beta glucans in oat milk may decrease the risk for cardiac disease, and that the calcium and lactose content in dairy milk is associated with both increased and decreased bone mineral density.

In reflecting upon what humans may need for maintaining health, the students undertake a holistic and personal approach to wellbeing. Rather than searching for the one "right" diet or lifestyle for all, they elaborate on how human needs may vary, for instance, with regard to age, level of activity and taste preferences. Drawing on their knowledge about ecosystem dynamics, the students examine how the use of local resources (such as fresh water and soil nutrients) in the production of milk may have environmental consequences on a regional or even a global scale. Recognising that resources such as fresh water are unevenly distributed around the world opens up spaces for the students to consider their own moral agency in caring for people outside their local contexts. In considering the conditions for human and environmental wellbeing, they express empathic concern and sensitivity for the situations and needs of other people and the places we live.

In the following, Excerpt E, Linnea, Zoe and Olle approach the milk issue from a health perspective. Their conversation revolves around which of the two milk drinks may be the healthiest to consume, and for whom.

Excerpt E: We have to care for the whole human being

48. **Linnea:** What's actually good for the human being?

49. **Zoe:** But it is so wide... Who it's good for? Like, the whole society or [a] person? There are so many stages. It's old, young. Dairy, I mean ordinary milk, is really good when you grow up.
50. **Linnea:** Yeah.
51. **Zoe:** And then you can replace it with something like this "Oatly" [oat milk brand] or whatever you choose.
52. **Linnea:** Yeah. But, like, kids... they need milk... or? That's why I... or I'm kind of allergic to milk.
53. **Olle:** Oh! So, you have more fragile bones? [laughter]
54. **Linnea:** No, but if you just, like, find... You can add, like, calcium and protein and such to oat milk. You can replace it completely.
55. **Zoe:** Yeah. I don't know. I think that Oatly is better for old people.
56. **Linnea:** Yeah. I think it's better for a thirty-year-old or, like, fifteen and older... eighteen maybe.
57. **Zoe:** OK, "thirty years old or, like, fifteen and older" [laughter]. But it totally depends on what kind of lifestyle you have. You can't say that "this is right for you, and this is right for you" if you don't know... I mean if we only consider the health perspective it depends on how much you burn and bla bla bla. What you need. What you like!...
58. **Olle:** It's [milk consumption] "associated with decreased weight gain" [cites from the Internet].
59. **Zoe:** But that's another personal thing, right?
60. **Olle:** Yep!
61. **Linnea:** But it depends on the whole human. We have to care for the whole human being... like, how she functions.
62. **Zoe:** But that's why we have to... should we care for the environment or people's health? What kind of question is this?

When Linnea invites her peers to consider what is also healthy for humans to drink (line 48), Zoe points to the complexity in human health (line 49). She argues that health can be considered on both a personal and societal level, and further that the notion of health needs to be considered in relation to different variables such as age (line 49). Zoe envisions that dairy milk may be preferable for children, while oat milk may be a healthier option for adults (lines 49, 51). By referring to dairy milk as "ordinary milk", Zoe positions dairy milk as the norm (line 49). Reflecting upon her own lactose intolerance, Linnea is somewhat hesitant in drawing general conclusions about the health benefits of dairy milk for children (line 52). When Olle finds out about Linnea's milk allergy he asks if she has "more fragile bones" (line 53). Seemingly, drawing on her knowledge that calcium is an important component for healthy bones, Linnea holds that such minerals can be added to oat milk (line 54).

After a few more comments in the group about what may constitute healthy beverages for children and grown-ups (lines 55, 56, 57), Zoe points out that age is not the only relevant aspect regarding human health. She suggests a more holistic and personal approach to health, suggesting that people's physical needs and taste preferences vary (line 57). Zoe's holistic and personal approach to human health is further exemplified in her response to Olle's claim about milk and weight gain (58). Zoe holds that people's weight is another "personal thing" (59). On a similar note, Linnea suggests that "we have to care for the whole human being" (61). The students challenge the dualistic medial picture of milk as either "good" or "bad". Rather than finding the one right way to live, they acknowledge the complexity of the issue. Zoe asks, "What kind of question is this?" (line 62). She discerns a conflict of interest between the need to care for the whole human and the environment in which people live (line 62).

The environmental challenges embedded in the production and consumption of milk are further elaborated on by another group of students. In Excerpt F, Rey, Karl, Lisa and Ali examine how the dairy industry may alter ecosystem dynamics on a local and global scale, and, further, bring questions of resource allocation to the fore.

Excerpt F: But I think about the environment around the world

63. **Rey:** I think, if you have cows that walk around outside and graze and then you give them a lot of forage, then they will get a lot of nutrients so they will produce a good amount of milk. But similarly they will also contribute to over-fertilisation in the surrounding areas, like, because they poop... [laughter] and then it starts to rain, and then it's spread out in the environment... then all those nutrients that we have tried to get into the cows will be spread out in the environment instead... that will affect the environment very negatively. Just like if a lake is over-fertilised, that we have worked with [in a school geography project]. That's no good!
64. **Karl:** Well, in that case, this [over-fertilisation] is actually more about organic milk since they [the cows] walk outside and graze. Otherwise, they are kept inside.
65. **Lisa:** And then I also thought about... much water is needed for the cows to survive. And water is scarce and extreme amounts of water are used up to produce milk... [a beverage] that may not be so healthy anyway.
66. **Rey:** Yeah, but water isn't scarce right here in Sweden?
67. **Lisa:** But I think about the environment around the world!
68. **Rey:** But... like, in Kenya you don't produce milk? If it's scarce you don't prioritise water [as a resource] for milk production.
69. **Ali:** No, but at the same time it's still that [scarce] around the world. So of course, you waste it anyway!
70. **Rey:** But, hm, we who have a lot of water... it's not like we donate our water.
71. **Ali:** No, exactly! And we can't even do that if we use it all up by having cows and milk!

Drawing on his knowledge about how nutrients circulate in limnic ecosystems, Rey suggests that grazing milk cows' faeces may cause accumulation of nutrients in the environment (line 63). Karl then points out that over-fertilisation may be more common in organic dairy milk production since the cows "walk outside and graze" (line 64). Lisa introduces another aspect of environmental impact, namely, use of freshwater. She suggests that this may actually be a waste of a useful resource, especially if dairy milk is not as

healthy as presumed (line 65). Rey objects to the position that fresh water is not scarce in Sweden (line 66). Lisa points out the importance of taking the global environment into account (line 67). Taking Kenya as an example, Rey specifies that people may not prioritise dairy milk production if water is scarce (line 68). Aligning with Linnea, Ali claims that since water is scarce in some countries, using it in other countries may be regarded as wasteful (line 69). Rey and Ali voice the idea of resources as being common and elaborate on a scenario of water donations (lines 70, 71). Together, they highlight a common responsibility for achieving people's equal access to fresh water.

4.3. Theme C: issues of awareness about beverage choice

The last theme illustrates how the students negotiate how to read or interpret the milk issue and its relevance from multiple standpoints. They raise different issues of awareness about beverage choice, for instance, related to perspectives of source critique on the Internet and how the norms around beverage choices are established and upheld in society. The students identify and address a number of established aspects of source critique, including the existence of potential biases, the publishers' purposes in disseminating the information (e.g., to inform or to sell), the quality and procedures of related research (here, nutrition research) and the ability to trace secondary sources. As the students discuss how societal norms play a part in shaping our lifestyle decisions, they examine how education, family life, cooking traditions, industry and the media function as co-creators of the Swedish "milk norm".

Furthermore, this theme illustrates how the students use narrative imagination to reflect upon what may be the consequences of an altered beverage consumption. In doing so, the students travel back and forth in time, attempting to navigate the milk issue through the experiences of past generations as well imagining the life conditions in a common future. Oscillating in time and space creates opportunities for the students to reflect upon the milk issue from a broader perspective on humanity, raising it to an issue of justice and people's quality of life. Assuming the perspectives of others enables the students to examine how life conditions may vary, and to practise empathic responsiveness and taking responsibility for other people's needs.

The excerpt below illustrates how the discussion about milk sparks a group of students into imagining what people's beverage consumption may look like in the future. Together, they examine how human health, climate change, people's emotions and financial considerations may come into play in restating our lifestyle choices for sustainable development.

Excerpt G: Do you think this is the future?

72. **Noel:** Do you think this [oat milk] is the future?
 73. **Leon:** Yeah, I think it's the future.
 74. **Samit:** Well, it also depends on how it will be in the future, hm, like how many people will be lactose intolerant and...
 75. **Noel:** But this [the oat milk] will surely be developed and given other qualities, hm, like milk, I think.
 76. **Leon:** It's possible to put protein and such in it!
 77. **Noel:** Yeah. Yeah, I think that if we develop the product more and try to get at more...
 78. **Leon:** More and more people are becoming sensitive to lactose and gluten and all that stuff.
 79. **Samit:** Yeah, so it will probably get more popular.
 80. **Leon:** Mm. Because of climate [change] more and more people will transition to vegan food and such.
 81. **Samit:** Mm. That's damn true.
 82. **Noel:** Since it's better for the environment.
 83. **Leon:** And for the "workout-body"!
 84. **Noel:** But, hm, then maybe this [oat milk] is an entry point for people to become like vegans?
 85. **Samit:** No way? ... but that's just...
 86. **Noel:** More and more vegetarians or vegans... Maybe.
 87. **Leon:** Vegetarians drink ordinary [dairy] milk.
 88. **Noel:** Yeah, but that's also an entry point! First you become vegetarian. You don't jump straight to vegan!
 89. **Leon:** You could, but it's [the oat milk] a help.
 90. **Samit:** But how does it matter?
 91. **Noel:** But, hm, you won't feel as good then.
 92. **Leon:** Maybe you eat other stuff that you get protein and such from.
 93. **Noel:** But it's just that food... it's really "mental" I think... but then you have to think... I mean if people are going to drink Oatly instead of milk, hm, I don't know what the prices are but if it is cheaper...
 94. **Leon:** It's more expensive!
 95. **Samit:** Right now! But that's because the production, hm, they don't have so many consumers.
 96. **Leon:** Yeah, exactly!
 97. **Samit:** We'll have to lower, hm, how much is milk? Seven crowns [SEK]? Per litre?
 98. **Leon:** Yeah, nine crowns [SEK]... maybe around ten crowns [SEK].
 99. **Noel:** And then you have to think about the farmers. How do they get, like, their income?

Noel invites his peers to reflect upon the suggestion that oat milk could potentially replace dairy milk in the future (line 72). Leon confirms the possibility (line 73), but Samit points out that it depends on how many people will be lactose intolerant (line 74). Noel and Leon elaborate on the possibilities of providing oat milk with a nutritional value similar to that of dairy milk (lines 75, 76, 77). Samit and Leon also reflect upon the possibility that food allergies may become more abundant in the future, and that people may become

more dependent on alternative beverages (lines 78, 79).

In addition to their concern for human health, the students imagine how the challenges of global warming may lead to a change in people's diet. Leon predicts that in response to climate change, people will need to transition to more plant-based diets (line 80). Samit and Noel concur (lines 81, 82). Leon suggests that a plant-based diet may be better for "the work-out body" (line 83). Acknowledging that changing food habits are difficult, the students examine whether oat milk could be an "entry point" for people to become vegans (84–85). Noel clarifies that jumping "straight to vegan" may make people feel bad (lines 91). When Leon suggests that people might get their "proteins and such" from other food sources (line 92), Noel argues that food is also something "mental" (line 93). Noel then contrasts his own suggestion about food as mental and reflects on how financial considerations may affect people's choice of beverage (line 93). Like Elvira (Excerpt B, line 23), the students discuss how market forces may influence lifestyle choices, and that a lower price might serve as an incentive for people to increase their consumption of oat milk (lines 94–98). Noel also considers the situation of the dairy farmers, whose livelihood depends on people's consumption of milk (line 99).

The students in Excerpt F imagine present and future common needs from perspectives of health, emotions and economy. In doing so, they express empathic concern for others and awareness that people's quality of life in the future is conditioned by how we live today. Such empathic imaginary work is further illustrated in Excerpt G that follows. By reflecting upon human responses to changed living conditions in the past, Ludvig and Tyra reflect upon what could serve as incentives for people to renegotiate their views and thereby change their ways of living.

Excerpt H: You have to find substitutes

100. **Ludvig:** It can be, like, hard to... that's why you have to find substitutes, hm, so that you don't need to replace everything.
101. **Tyra:** It's also about the situation. If we get into a situation that is, hm, where there is no longer... this is really a crisis... like, we have to change. Then it becomes possible to, like, adjust. Because it's when there's an alternative that we can continue like this, that it goes well. Hm, I think that if... say that you would eliminate smoking. If we were to ban it completely...
102. **Ludvig:** Mm?
103. **Tyra:** If it's really like that there is a complete crisis. Then, despite being pissed off, people would listen, hm, partly because... it would be like the second world war when people used coupons!
104. **Ludvig:** Yeah?
105. **Tyra:** Then you adjust to the situation.
106. **Ludvig:** Yeah. But what kind of situation do we have? We have to understand the situation. How should we interpret the question [about milk]?
107. **Tyra:** We don't live in that kind of situation. We live in total luxury, so we don't discern this as a problem! It's, like, ... milk is standard.

Ludvig points out a need to find substitutes for dairy milk in case of a shift in people's diets "so that you don't need to replace everything" (line 100). Tyra expresses the view that people may be willing to change their habits if the incentive for doing so is very strong. She imagines that in the case of a future crisis it may become possible for people to adjust their ways of living (line 101). She clarifies her point by comparing the milk issue with smoking. She argues that there is a need to actually forbid smoking in order to make people quit (line 101). In referring to how people used food coupons during the second world war, Tyra also highlights how people in the past have been able to change their ways of living in extreme situations (lines 103, 104). Tyra's reasoning about potential incentives for lifestyle changes sparks Ludvig into questioning "what kind of situation" we have today. He stresses that judgements on dairy and oat milk from perspectives of sustainability need to start with a mutual understanding of the present situation (line 106). Referring back to historically harsh living conditions opens the space for Tyra to express an awareness of her own privileged position: "We don't live in that kind of situation. We live in total luxury...", she exclaims (line 107). From such a standpoint, people do not discern the potential need to reflect upon how they live their lives, she argues (line 107).

Altogether, Excerpts F and G, above, illustrate how enactments of compassion and imagination enable the students to examine lifestyle-related issues as personal and situated, closely tied to the circumstances and context of the individual. Even though the students discern the human vulnerability to illness and climate change as something commonly shared, they also acknowledge that the needs, conditions and incentives for lifestyle changes vary. This becomes an example of narrative imagination as "a particular quality of vision" that conjectures sympathetic responsiveness to other people's needs, as well as understandings of how circumstances may shape those needs (Nussbaum, 2011, p. 88). Excerpt F provides an example of how such a vision may become available through the experiences of past generations. Historical narratives from the second world war here open up spaces for the students to envision the living conditions of past generations, and thereby to examine people's abilities to respond to altered living conditions in contemporary societies.

5. Discussion and implications

In this study, we have explored how students' encounters with complex societal issues may bring a diversity of perspectives into the science classroom, and the moral controversies and tensions between different stakeholders that typically follow (see also Jiménez-Alexandre & Brocos, 2017). Even though Swedish media reporting on dairy and oat milk at the time of data collection could be described as polarised, the students expanded and nuanced the notion of milk in integrating and contrasting multiple perspectives. For instance, the students approached human health in ways that became meaningful for them personally, taking a broader perspective than the purely nutritional aspects focused on in the media. Resembling how students' in the study by Arvola Orlander and Lundegård

(2012) expressed a holistic understanding of the human body, the students in this study discussed how milk affects human health both physically, mentally, and socially.

By using Nussbaum's theoretical framework as an interpretative lens, we have provided examples of how students' critical examinations include scrutiny of norms, traditions and personal habits, recognition of oneself as bound to others by ties of concern for human and environmental wellbeing, and also, narrative imagination of ways to a sustainable and morally just future. Based on our results we argue that the notion of "world citizenship" contributes to bringing forward qualities and nuances in students' critical examination of the milk issue that have not been foregrounded in previous science education research on argumentation and critical examination. In the previous research, there has been an emphasis on the ways in which students understand and use scientific concepts, and how they produce evidence-based arguments for the purposes of personal decision-making and persuading others (Erduran & Jiménez-Aleixandre, 2007; Nielsen, 2013). There has also been a focus on students' recognition and acknowledgement of multiple perspectives as ways to tackle the complexity of socioscientific issues (e.g., Kahn & Zeidler, 2016; Solli, 2019). However, from a perspective of world citizenship, we conclude that the interest — in *how many* and/or *what types* of perspectives students use in critical examination of complex issues — tends to leave an important question unexamined: in what ways may the use of multiple perspectives be applied to enable more advanced critical examination. Instead, the value of perspective-taking in previous research seems to build on a somewhat self-explanatory recognition that when issues are complex, they need to be approached with an open mind for wise decision-making to occur (cf. Wiblom, 2020). By drawing on Nussbaum's notion of narrative imagination, this study makes explicit how taking the perspectives of others may open up spaces for the students to bring an ethic of compassion and care into science education; a sort of moral compass that develops as we imagine what it would be like in the shoes of another person.

In the present study, we have also illustrated how the capacities needed for "world citizenship" suggested by Nussbaum (1997) are intertwined in the sense that they both condition and create the need for each other. As the students direct their critical examination towards Swedish milk culture and the research communities that produce knowledge about nutrition, the need to take the perspectives of others and to reflect upon the circumstances that shape people's lives arise in the student groups. Conversely, the way students compassionately consider the milk cow's perspective sparks a critical examination of the moral values that underpin their own choices around food. The notion of "world citizenship" thus sheds new light on the aforementioned traditionally recognised qualities in students' critical reasoning in science education. In this study, we show how the students made use of domain-specific knowledge about ecology and nutrition to practise a compassionate concern for other people and their common environment, pointing to the interplay of factual knowledge and emotions (c.f. Alsop, 2017; Kahn & Zeidler, 2016). In examining the milk controversy, the students displayed a willingness to question what is taken for granted in Swedish society by scrutinising their own food culture and personal or societal beliefs about milk. They also expressed an openness with regard to the need for change in achieving a sustainable future, while remaining humble about the potential challenges that related changes may bring about for people, both in their own society and globally. Nussbaum describes narrative imagination as "a particular form of vision" that opens up spaces to assume the perspectives of others (p. 88). The students used their imagination to collectively construct visions for a sustainable future and potentially provide insights into how critical scrutiny can develop and add (rather than debunk) new ideas in science education (see also Latour, 2004).

This study points to the prominent role of science teachers in considering what characteristics of socio-scientific issues to introduce to students, as well as the manner in which students are invited to critically engage with these issues. With reference to Socrates, Nussbaum writes that "[e]ducation must be very personal. It must be concerned with the actual situation of the pupil, with the current state of the pupil's knowledge and beliefs, with the obstacles between the pupil and the attainment of intellectual freedom" (p. 32). As illustrated in the study by Jiménez-Aleixandre and Brocos (2017), bringing issues that challenge existing cultural preferences, habits and established knowledge around food into science education may open up spaces for students to become aware of their own pre-suppositions and values about food. When issues raise contemporary tensions and disagreements within research societies, for instance, with regard to the health benefits of milk consumption, opportunities may be created for students to examine how science is produced in communities of science (see also Wiblom, 2020). Establishing a classroom practice that embraces the students' own constructions of closeness and care, rather than imposing rhetoric and resolution when encountering otherness may open up spaces for the practicing of "world citizenship".

Bringing Nussbaum's notion of narrative imagination into science education offers an understanding of the critical examination of science that is tied to purposes beyond the fostering of conscious consumers or informed decision makers. The concept enables us to understand the purposes of engaging in critical examination as a process of becoming aware of habits and values and to accept and live with "otherness" rather than finding easy or right answers to complex issues. When students are confronted with plurality and otherness in science education, in ways that allow for emotional engagement and self-scrutiny, possibilities arise for addressing issues of justice, wellbeing and humanity. Inevitably, assuming the perspectives of others and scrutinising one's own views and beliefs also makes the world a more complicated place to live in (von Wright, 2002). In previous research, there has been a call for the development of classroom activities that enable students to encounter sustainability issues through emotional, creative and innovative processes (Lundegård & Caiman, 2019). Inviting the students to collectively construct visions for a sustainable future using imagination, appears to hold promise for establishing innovative science teaching and learning practices.

A considerable amount of research on students' critical engagement with complex issues examines students' learning from an individualistic perspective, assuming knowledge to be individual (Bencze & Alsop, 2014). In this study, the analytic focus has not been on the individual's knowledge or capacity for critical examination, but on how groups of students are involved in interactions with others and with context — both in the immediate school situation and in society at large. From such an epistemological standpoint, Nussbaum's theoretical framework allows us to articulate critical examination in science education as a collective and situated process of questioning what is taken for granted, neutral or natural by negotiating values and norms. Here, science education teachers and researchers share an important role in developing classroom practices that allow for the students to critically examine multifaceted

science-related issues that cut across areas of knowledge, nationalities, traditions, value systems and even species. From our standpoint, science education holds rich promise for contributing to the fostering of compassionate citizens. That is, citizens with a moral compass sensitive to their own needs as well as those of other humans and non-humans globally.

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